

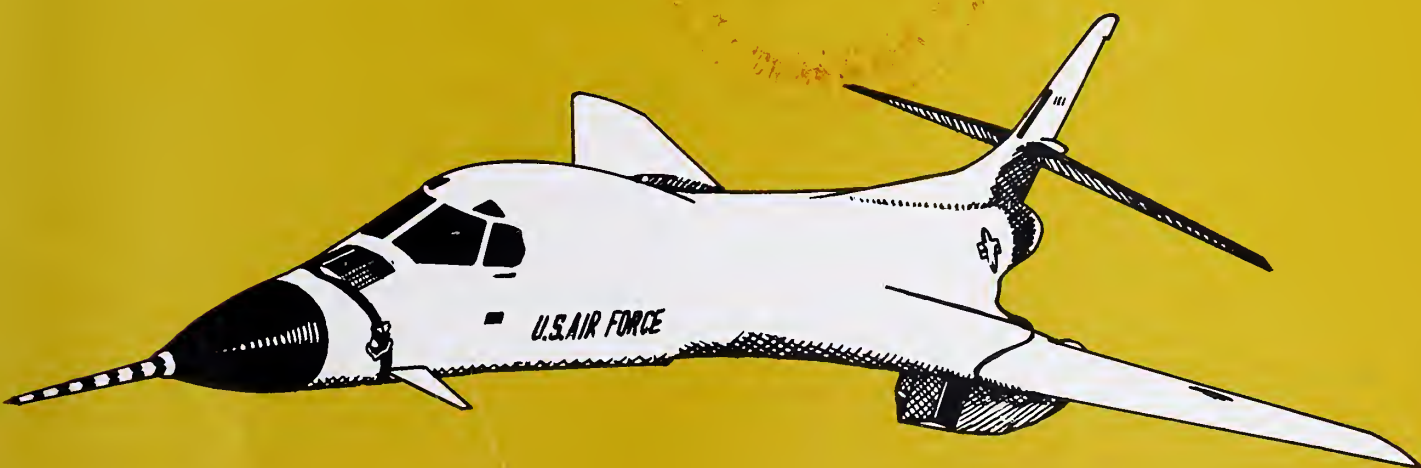
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Combat Crew

strategic

air

command



FEBRUARY 1976

FLARE

Combat Crew

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COL. JESSE S. HOCKER
Director of Safety

STAFF

MAJ. RICHARD W. BLATTER
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G. FRANCIS FARRELL
Associate Editor

AIC GERALD F. MORIARTY
Art Editor

MARY JANE ABBOUD
Editorial Assistant

ON OUR COVER



From Kitty Hawk to Edwards sound engineering and flight test programs have produced machines with amazing flying qualities. See page 4.

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MAJOR GENERAL A. B. ANDERSON, JR.
HQ SAC Chief of Staff

The "old heads" in SAC still reminisce about the "good old days"—when the crew force consisted of majors and lieutenant colonels, most with several thousand hours of flying time. These were the times when a lieutenant on a combat crew was unheard of, and a captain crew commander a rarity. How times have changed! The current trend toward youth started in the missile career field. There—when the "crossover" force of flyers turned missileers became depleted—the command began entrusting control of the sophisticated missile systems in the SAC inventory to a crew force comprised mainly of captains and lieutenants. This practice has continued, and in recent years the aircraft side of the house has followed suit. Today, the average age in the missile crew force is 26. The B-52 and KC-135 aircraft commanders average 31 and 29.7 years of age respectively. In 1969, the figures were 35.7 years for the B-52 aircraft commanders and 36.4 years for the KC-135 crew commanders. The average age of the missile crew force has remained relatively constant during this period.

The same "old heads" I mentioned earlier have questioned the ability of the young, less experi-



THE "YOUNG" PROFESSIONAL SAC CREW FORCE

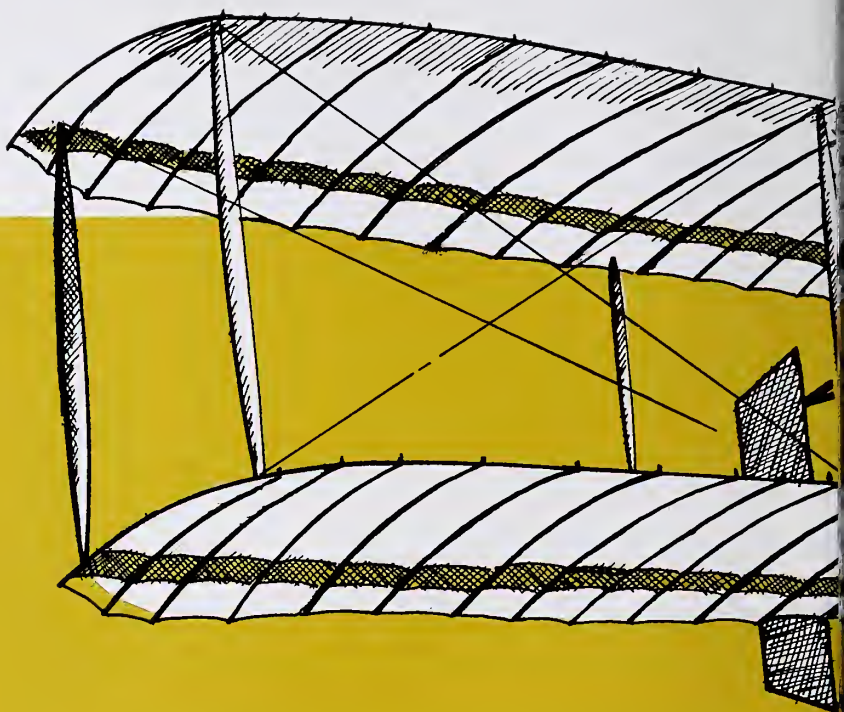
enced crew force to operate effectively and to manage the complex weapons assigned to the command. But the record speaks for itself. The SAC missile crews have maintained an unprecedented rate of nuclear alert. SAC aircrews have made the same smart "dime" turns, neatly bombed the assigned "triangles," maintained the required levels of alert, and have performed superbly in other assigned roles. The "BULLET SHOT" and "LINEBACKER II" operations during the war in Southeast Asia are examples of their fine accomplishments. The fact that the command has accomplished successfully its primary mission of nuclear deterrence attests to the professionalism and dedication of its crew force.

It is true that our people are young age-wise. But in a sense, the crew force is 30 years old and possesses the experiences of all those who

have preceded them. As General Dougherty recently pointed out, our predecessors were far-sighted enough to record their experiences and to write down what they had found to be sound operating techniques and procedures. As a result, today's crew force has inherited a wealth of experience. It is found in the manuals, regulations and tech data which have evolved over the years.

This inheritance is becoming increasingly important. Recent cutbacks in command resources have reduced our capability to provide combat crews with the quantity of training which they have received in the past. Reductions in the command's flying hour program have decreased the number of sorties available for crew training. This has resulted in greater emphasis being placed on ground training: Increased use of simulators is

(continued on page 24)



BORN TO FLY.....

ROBERT T. HOWARD
Lt Col, USAF Retired

Fortunately in the conduct of routine flying operations, the breaking or bending of an aircraft in flight is difficult. However, it does occur infrequently, sometimes with spectacular results. If it does happen, it requires somewhat more than a passing familiarity with this business of flight—especially if you're the pilot. Preventing this type of accident or any mishap in which part of the aircraft structure is damaged or destroyed is important. It demands first priority, but if the problem does arise, make the most of the situation. It may be possible to safely land the aircraft, or it may be that the best you can do is to provide a stable platform for departure from the disabled machine.

We have never had an aircraft of questionable control capabilities produced for the field. No doubt pilots with some experience in the numerous "widowmakers" will argue this point. But for the most part, the undesirable characteristics of these legendary birds was described in the slender flight manuals of the era. Obviously these aircraft could fly, and fly well.

Considering the present state of the art, two observations come to mind. Either our aircraft have reached a state of design stability literally defying the imagination, or our pilots exceed the old proficiency level. Probably some combination of both these factors contribute to the continued reduction of our accident rate while pushing the vehicles and crews that fly them to levels historically without parallel. Witness the difference in speeds and response periods today when even our administrative courier aircraft far exceed the performance of combat aircraft of another era. Certainly today's aircraft have unique flight characteristics which require more than a nodding acquaintance with aerial endeavor. However, these aircraft are stable and certainly controllable throughout a wide range of performance. Nevertheless each of these aircraft still require a flight manual to describe operating procedures and techniques. Each contains a liberal sprinkling of WARNINGS, CAUTIONS and NOTES, but try to find one that states: "WARNING: DO NOT TAKE THIS AIRCRAFT INTO THE AIR."

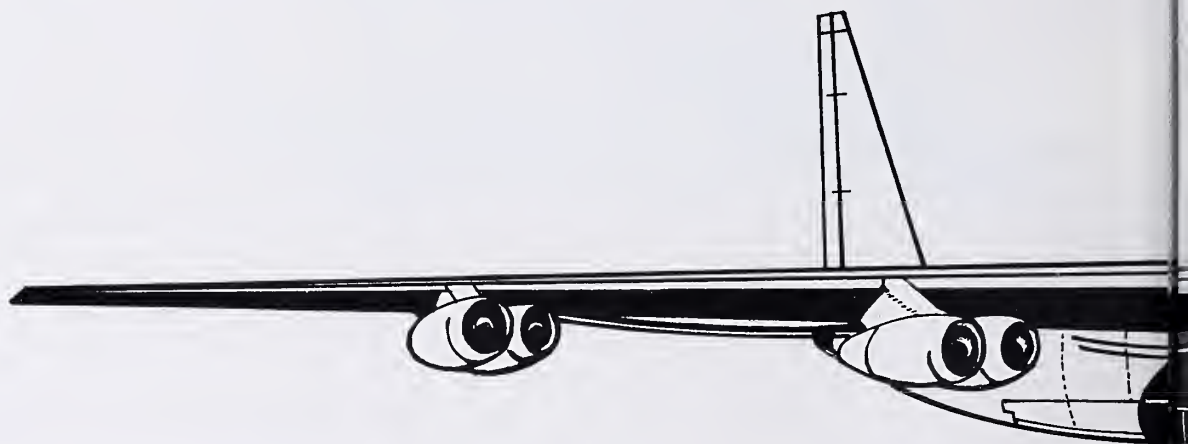
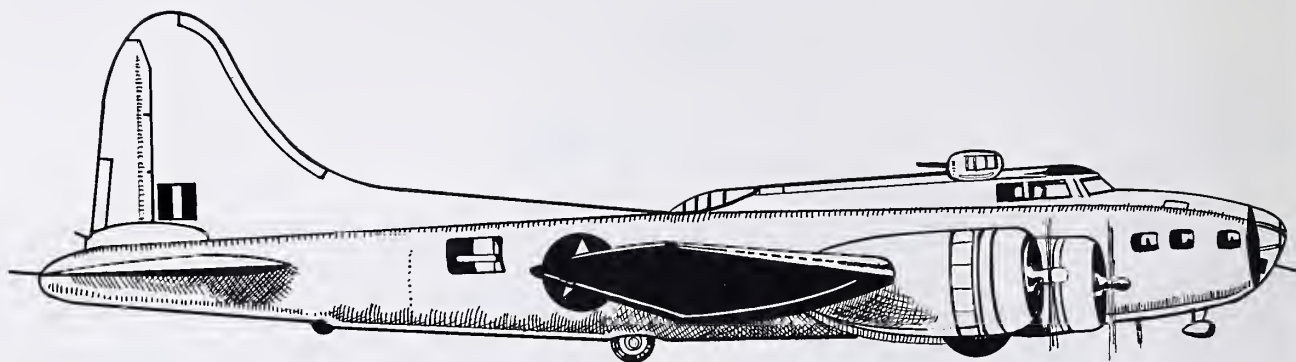


It is a good exercise to review some past incidents in which, combined with all of the right ingredients, aircraft and crews coped with serious inflight emergencies. From the beginning, designers and builders of flying machines agreed that all birds had tails; this being the case, it must be a fine idea for aircraft to follow this example. This is a significant fact since it is not, and has never been particularly easy to get wholehearted agreement between designers. Even in this enlightened era, no serious argument opposes this theory. Each of our aircraft is equipped with one each issue type tail—not a uniform one to be sure—but the basic requirement and recognizable shape is present. Even after years of substantiation of this very point, a B-52 did fly without its vertical stabilizer. Consider the circumstances of that flight. The aircraft encountered severe turbulence at low level of such magnitude that an essential portion of the aircraft structure was lost. It is difficult to imagine a more demanding set of circumstances. It required all of the resources of the aircraft and crew to return this bird safely to terra firma. Please do not misconstrue the re-

lating of this incident as a recommendation to delete vertical stabilizers in the next economy drive, but the proper operator action in this case saved the aircraft and crew.

In the late fifties and early sixties, lengthy research failed to unearth any consideration to fly the B-47 without a matched set of wings. Yet one did an admirable job returning to the home drome on what was left of a wing and a prayer. Aerodynamically, this bird was in the same category as the proverbial bumble bee; no one told him he could not fly! This set of circumstances resulted after a collision with another aircraft. The crew was left in a difficult situation which, hopefully, you will never be in, but by combining all of the right decisions and skills, the aircraft landed safely.

In no description of the air refueling operation is it recommended that the tanker and receiver contact position mean more than contact between the boom and the refueling receptacle. Unfortunately, this distance has been exceeded—on the short side. Some years ago we had a KC-97 and B-52 meet inflight at considerably less than



boom length with distressing results to the aircraft. After a period of normal refueling practice, these two aircraft made contact—nose - to - tail—with considerable damage occurring to both. Even so, both aircraft returned safely to suitable runways without the loss of a single crew member. A look at the results of this particular midair makes it difficult to understand how a safe recovery was accomplished.

During takeoff, a heavily loaded jet airliner lost an outboard engine along with a goodly portion of the wing. It might not seem reasonable for the aircraft to remain airborne in this configuration, but the fact is—it did fly! It flew well enough to dump fuel, reduce gross weight and allow sufficient time to select a suitable runway. Judicious decisions under trying circumstances provided a margin of safety during this extremely demanding situation.

Maybe sometimes a basic fact is forgotten under the stress of a situation. It is the aircraft that flies, the pilot that controls. Have you ever heard of “antagonizing an aircraft?” It is a phrase used to describe unnecessary control inputs by the pilot when he is apparently attempting to physically hold the aircraft in the air. After relaxing their firm control, pilots who are anta-

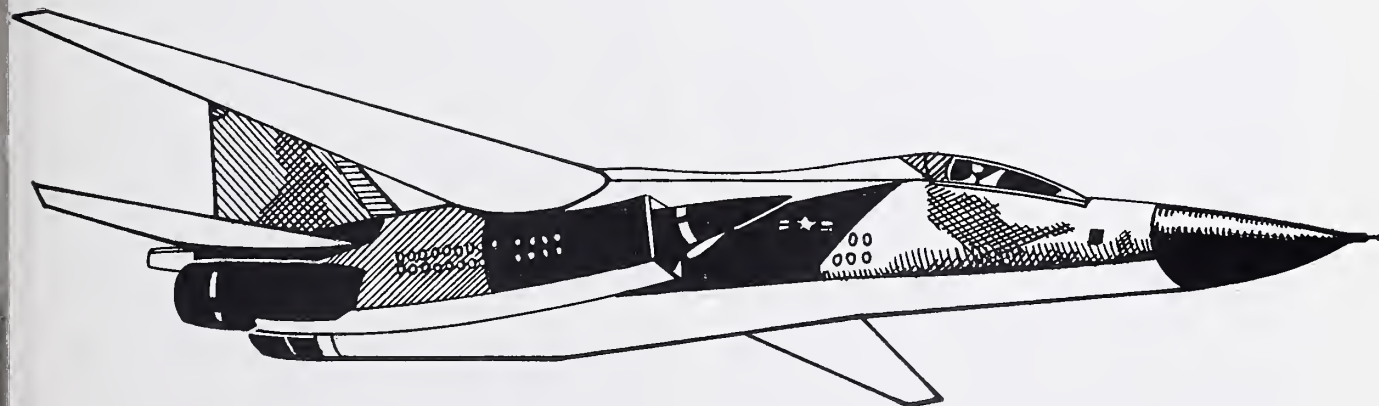
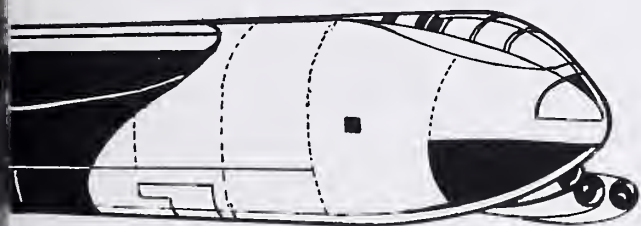
gonizing the aircraft are usually amazed to find how splendidly everything has smoothed out. After easing control inputs, we found how much easier it was to guide rather than hold.

Another example might be a rather untypical refueling operation. You needed maximum fuel in minimum time. It was a black night, no moon, weather all the way through the refueling area, the bird was badly out of rig and to top the frosting on the cake, the tanker was rough! About half way through the refueling area, the sweat began burning the eyes and the mouth filled with cotton. Even the older heads tire a little bit under these circumstances and relax an extraneous pressure or two. It was exactly at this time that the cloud tops decreased to well below the refueling altitude, the aircraft rigging improved and the tanker settled down nicely. Ironically you found that it was not going to be necessary—or possible—for a 170 pound pilot to physically support a few hundred thousand pounds of aircraft.

You might reasonably expect to use the information in Section III of the flight manual. Fortunately, when the time comes you will have a number of things going for you. First, you started with a fine piece of equipment admirably equipped to do its part in coping with the situation. Secondly, helping to make the right decision in the available time will be the sum total of your training and experience. Hopefully, this background will provide an instant "readout" from your personal memory bank. Every single contribution from past experience should provide storage material. It may be the time when you must decide if the aircraft will continue to fly, and if so, for how long. But before continuing let me reemphasize the point; you must let the air-

craft fly while you control and think. It may be a leisurely leaf through the pages while "George" handles the wheel, or it may require a split second reaction spelling the difference between routine and catastrophe. In any case, this is the area where pilot reaction is the single most important function—the difference between success or failure. The flight manual states it rather well: STOP . . . THINK . . . COLLECT YOUR WITS.

Reaction from the comfort of an upholstered chair or the snack bar is considerably less demanding than that in the confines of the cockpit, but forethought and consideration for that moment will pay dividends. In the more motivating atmosphere of the cockpit, you must decide if the aircraft can continue to fly. It may require a good bit more than routine assistance. It may even tax your utmost capabilities. It may be that further flight will exceed your capabilities and the capabilities of the portion of the vehicle that is remaining. The increasing risk to crew or passengers may not be worth any further action. In a case like that, the simplest reaction would be to provide the best possible platform for bail-out. You must use the available time to make your decision, and once made, it is improbable that surplus time will be available. Concentrate your attention on executing your course of action, but remember the basic fact is—that bird was born to fly!



CAPTAIN LUTHER R. WILSON
55th SRW/SE Offutt AFB
Photos by SSgt Tom Griffin

1 Jan 1966 - 30 June 1971

Probably nobody receives more caustic comments from fellow crewmembers than the copilot (navigators may doubt this). He is the brunt of many a remark concerning ability, maturity, judgment, and even the necessity of his presence. I am reminded of the F-105 pilot fresh from 100 missions over North Vietnam who met the fate of being assigned to a multiengine airplane upon his return to the states. As he strapped in for his first flight he turned to the copilot and said, "Don't do anything during this flight unless I ask you to assist me." You see, he didn't want to get out of the habit of doing it all himself.

What was the original reason for designing aircraft with more than one pilot position? I think one of the reasons had to do with the possibility of one of the pilots becoming incapacitated

Aircraft Type	Causes of	
	Loss of Consciousness	
Trainer	16	
Transport	4	
Fighter	9	
Bomber	2	
Helicopter	1	

Civil aviation is not exempt from this problem. An ICAO study from 1961 - 1968 discovered 17 inflight pilot deaths resulting in five accidents and 148 deaths.

Crewmember incapacitation can be either physical or mental or both. It can be an obvious incapacitation. This type often involves total loss of function and the onset is usually sudden and the duration prolonged. Examples include heart attack or stroke. The much more dangerous incapacitation from a crew survival point of view

INCAPACITATION

and unable to safely carry out his function at the controls. Because of the rapid advance of technology since the early days of flight, and increasing complexity of aircraft and mission responsibilities, we often tend to forget that reason.

This actual case is an example of what I am talking about. On final approach the pilot was flying the aircraft. Just prior to the outer marker, the rate of descent was noted to be slightly high and the altitude was several hundred feet below that altitude desired at the outer marker. The pilot did not respond to an altitude warning from the copilot. The copilot took over the aircraft and executed a missed approach. After the copilot successfully landed the aircraft, the pilot took over the controls and taxied the aircraft to the parking area. The pilot was unaware that the copilot had taken control of the aircraft, flown a missed approach, and had made the landing. Later the cause of the pilot's apparent incapacitation was found to be petit mal or silent epilepsy.

During the period 1 January 1966 through 30 November 1971, the Air Force experienced 89 cases of incapacitation. Twenty-four of these resulted in fatalities. Loss of consciousness was the largest single category of sudden incapacitation. Loss of consciousness by aircraft type is as follows:

is the pilot who develops a subtle incapacitation. Common causes of this are hypoglycemia (low blood sugar often caused by poor eating habits), certain brain disorders, and psychological conditions. All may be transient lasting minutes or seconds.

Several years ago on a flight from the mainland to Hawaii, my copilot exhibited a form of subtle incapacitation. It was his first overwater flight and took place at night in a KC-135. As we approached Hawaii and made the radio transfer from Hickam Airways to Honolulu Center, I began to realize something was wrong. Center called several times and the copilot did not answer. At first I suspected improperly set radio switches; however, this was not the case. I asked the copilot if he heard Honolulu's calls. He just sat in his seat staring straight ahead and making no movement. Being more than a little upset, I hit him across the chest just to get his attention. He moved slightly, but made no comment while continuing to look straight ahead. I gave up at that point because I could wait no longer after sensing a rising tone of voice from Honolulu Center. I continued the remainder of the flight myself reading the checklist, handling several radios and trying to pick out the lights of runway 04 at Honolulu International among all the harbor



lights along the shore. It was not an impossible job by any means, but I wasn't as prepared for that situation as I could have been. I was certainly behind the power curve during that final portion of the flight.

The purpose here is not to discuss the medical aspects of pilot incapacitation, but rather to point out that it does happen, often in a very unsuspected and subtle way. Most crews could probably be better prepared to handle a situation involving incapacitation.

Once a pilot is incapacitated, at least three actions must be taken: 1) Maintain aircraft control; 2) Do something about the incapacitated pilot; 3) Reorganize cockpit duties and continue the flight. How you handle these problems depends on the type aircraft and crew makeup. Obviously, there are a lot more options avail-

able in a B-52 than an F-4.

Here are some ideas to consider when a pilot becomes incapacitated. The remaining pilot should take control of the aircraft and check the position of essential controls and switches. Any other available crewmember, such as the navigator, should restrain the incapacitated pilot and slide his seat back. Make sure that his feet are free of the rudder pedals and his arms are away from the yoke. Recline the seat back and lock the shoulder harness. If possible, the incapacitated pilot should be removed from his seat.

At this point, cockpit duties should be reorganized in preparation for landing. In most cases of severe incapacitation, medical personnel should be alerted and an emergency should be declared. You might consider use of the autopilot to reduce workload if the situation dictates.



What you do varies with the type of incapacitation and the standard operating procedures for your aircraft and crew position. It is important to note that these are suggestions and not authoritative requirements.

If you are in the area of your destination you might give ATC an estimate of your delay. Requesting a holding vector rather than using a conventional holding pattern can reduce your workload while you are assisting the incapacitated pilot. Don't get in a hurry. Don't let your concern for the pilot rush an orderly handling of the final portion of your flight.

If the aircraft commander becomes incapacitated should the copilot change seats? It is not desirable to increase already high stress levels by placing the copilot under conditions with which he is not completely familiar. Other factors are involved depending on aircraft type. For example, does the copilot position have anti-skid available? When is the last time the copilot tried braking the aircraft to a stop from the right seat with no anti-skid or nose wheel steering as is the case in the '135? Who is going to read the checklist? Should the navigator or another available crewmember handle the radios? These are only a few

of the questions which will arise should you be faced with an incapacitated crewmember during flight.

One final thought concerns the reluctance of the copilot to question the aircraft commander about a deviation from the optimum flight path. Solutions are often easier to write about than to put into practice. As far as the copilot knows, there is nothing wrong with the aircraft commander (in the case of subtle incapacitation). Lack of copilot experience may also be a factor. Thus he may hesitate to say anything as a result of assuming the pilot is functioning properly.

Much can be done to increase crew alertness to incapacitation and in my judgment crew effort in preflight actions as well as in the simulator is the secret to success. One way to increase crew awareness of incapacitation is a better preflight briefing between pilot and crew. The aircraft commander can brief his crew that they should not assume he is functioning properly at all times. If the copilot suspects the pilot is incapacitated or unaware of a deviation, he should immediately bring it to the pilot's attention. There should be no fear of reprisal from the pilot should the copilot say, "I've got it." Another way to solve

this problem is by the use of a crew program which includes practice in the simulator and a thorough discussion before and after the simulator mission.

United Air Lines has made an extensive study of pilot incapacitation. Numerous simulator flights were conducted at their flight training center in Denver, Colorado. Initial tests involved obvious pilot incapacitation. During critical phases of flight one of the pilots would simulate loss of consciousness and slump over the controls. Although crews had not had prior training in this type of emergency, no loss of aircraft control took place. A third crewmember restrained the unconscious pilot, moved his seat aft to free him from contact with controls, and placed the seat in the reclined position. The copilot continued the flight.

Striking contrasts were noticed, however, when the incapacitations were of the more subtle type. Prior to the simulator flight, one of the pilots was taken aside and briefed that while flying an instrument approach he would make no sudden movement after the final approach fix. He would simply cease to function and remain quietly in his last physical position with head and eyes straight ahead. It took some crews as long as three minutes to detect that the pilot in control was not functioning. Frequent unsafe conditions developed and 25% of these situations terminated in simulator ground impact. A serious secondary problem was the reluctance of junior crewmembers to question their superiors about mounting

deviations from the scheduled flight path.

From these tests United developed their "two communication" rule. If a pilot fails to respond appropriately to two verbal communications he is considered incapacitated and the other crewman takes over the pilot duties.

United's answer to pilot incapacitation may not work for you. But have you got a method of handling pilot incapacitation? Do you discuss and brief incapacitation? Do you practice this type of emergency in the simulator?

Although our combat mission in Southeast Asia is history, here is a final example where proper training might have averted disaster. During the Vietnam conflict, a friend of mine was flying a multiengine airplane at low altitude when an incoming small arms round struck its target and rendered him helpless while still at the controls. The aircraft was in a right base turn to final and the copilot was looking to his right. None of the other crewmembers were aware that the aircraft commander was dead in his seat. The plane continued its right descending turn and crashed short of the runway.

I've had copilots accuse me of being incapacitated from the minute I get out of bed in the morning. In spite of that, we had never developed a plan or discussed our actions should one of us become really helpless. I hope you'll take the time to do so and practice in the simulator on your next ride.



ABOUT THE AUTHOR: Captain Luther R. Wilson has been the flying safety officer for the 55 SRW since July 1975. He is a graduate of the University of Iowa and holds a masters degree in business administration from Golden Gate University, San Francisco. A senior pilot with over 4000 flying hours, he currently flies the SAC Airbourne Command Post.

WIND SHEAR: THE MYSTERY OF THE VANISHING AIRSPEED

by CAPT BARRY SCHIFF, TWA

■ On June 24, 1975, an Eastern Airlines Boeing 727 crashed on short final approach to New York's JFK International Airport. More than 100 passengers perished, making this one of the worst air disasters in U.S. history.

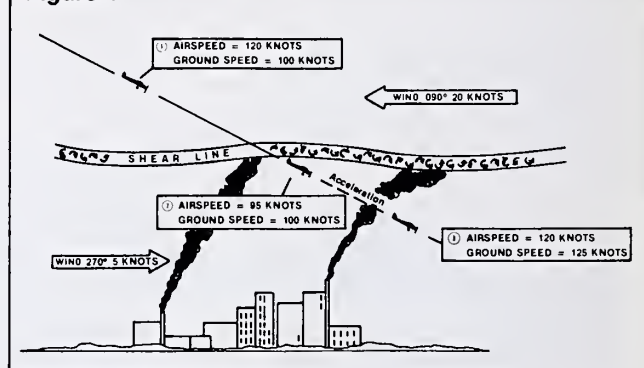
Based on the initially available facts, it appears that wind shear was an influential factor in the accident, if not the primary cause.

Because of this accident's spectacular nature, considerable attention is suddenly being focused on wind shear. It is almost shameful that a disaster of this magnitude was required to attract industry-wide attention to a phenomenon with which pilots have always had to cope.

Air carrier aircraft, of course, are not the exclusive victims of this invisible hazard. General aviation aircraft also fall prey to this misunderstood, underestimated menace. Hundreds, if not thousands, of accidents presumably caused by pilot error were direct or indirect results of wind-shear encounters. It is imperative, therefore, that pilots become familiar with the potentially lethal effects of wind shear and the various conditions during which these effects are most likely to occur.

Simply stated, wind shear is a variation in wind velocity (speed and/or direction) that occurs over a relatively short distance. *Airspeed* is affected when an airplane is flown from one wind condition—through a wind shear—into another wind condition in less time than *ground speed* can adjust to the new environment. The consequences can range from

Figure 1



annoying power and attitude corrections to complete loss of control.

Wind shear is a unique hazard not only because it is frequently undetectable, but because so many pilots are unable to acknowledge the threat. They consider it incredible that a change in wind velocity can alter airspeed; it is contrary to their earliest lessons in flight.

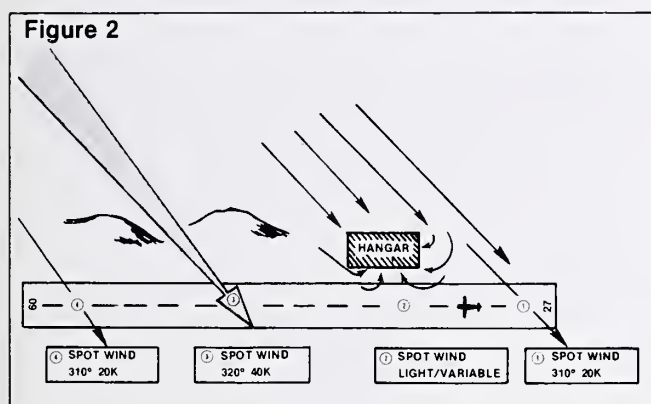
"Airspeed," they were taught, "is determined solely by variations in aircraft attitude, configuration and power setting; wind affects only track and ground speed."

Unfortunately, this simplistic axiom is but the tip of another iceberg and applies only when the wind is constant or changes gradually. Unless a pilot examines what lies beneath the surface, he is liable to fly unwittingly into the jaws of

what is coming to be regarded as one of aviation's most insidious killers.

The subject is seldom taught in ground school because instructors either don't want to complicate a student pilot's comprehension of the basic airspeed/ground-speed relationship or don't fully comprehend wind-shear fundamentals.

To understand wind shear is to recognize that an airplane has inertia and as a result resists a change in ground speed. This is best stated by paraphrasing Sir Isaac Newton, the brilliant English physicist who developed the inescapable laws of motion: An aircraft in flight at a given ground speed tends to remain at the same ground speed unless acted upon by an exterior force.



An application of this is illustrated in Figure 1. A temperature inversion overlies a coastal city from the ground to 2,000 feet. Within the inversion, the wind is westerly at 5 knots. Immediately above, the wind is easterly at 20 knots (not an unusual situation). The narrow band separating the two "air masses" is called a "shear line."

An aircraft descending toward the shear has an airspeed of 120 knots; its ground speed is obviously 100 knots. This ground speed represents aircraft momentum with respect to the earth and, according to Newton's First Law of Physics, is the quantity that resists change.

As the aircraft penetrates the shear line and enters the inversion, ground speed will increase, but not instantly. Because of aircraft inertia, ground speed after crossing the narrow shear line is very nearly what it was earlier, 100 knots.

But since the aircraft is now under the influence of a 5-knot tailwind, something has to give. That something, unfortunately, is airspeed, which reduces from 120 knots (above the shear line) to 95 knots (below the shear line), a net and rapid airspeed loss of 25 knots. Notice that the theoretical airspeed loss (25 knots) is equal to the difference between the headwind and tailwind components above and below the shear line.

The reduced airspeed, of course, results in reduced drag. Assuming that neither attitude nor power is changed, the aircraft accelerates to its original trimmed airspeed (120 knots), at which thrust and drag are again in balance. But because of inertia, this acceleration takes time; lost airspeed cannot be recaptured instantly.

Just how long it takes to recover lost airspeed was dramatized in a USAF report by Major C. L. Hazeltine. He demonstrated that if a given aircraft, maintaining a constant altitude and power setting, encounters an abrupt 20-knot loss (due to wind shear), recovery of only 10 knots would require 78 seconds; recovery of 16 knots would require 176 seconds. Adding power and/or sacrificing altitude reduces recovery time significantly and points out the alarming need for pilots to be particularly alert for a low-level wind shear when on final approach or when climbing out at marginal airspeeds. The problem of airspeed recovery is critical if the airspeed loss results in the drag rise associated with flight behind the power curve, when required power and altitude may not be available.

(In reality, the airspeed loss is not quite as large as shown in Figure 1 because some acceleration occurs while the aircraft crosses the shear line, depending on the line's width.)

Would the pilot in Figure 1 have any warning about the impending airspeed loss? In this case, yes. When two opposing air currents rub shoulders, there is bound to be some frictional turbulence. The degree of turbulence increases in proportion to the change in wind velocity and decreases in proportion to the width of the shear line. For similar reasons, the air surrounding a jet stream is often turbulent, even though a smooth ride can be had within the core.

The aircraft in Figure 1 encountered a rapidly decreasing headwind, which has the same effect as an increasing tailwind: an airspeed loss. If the direction of the aircraft is reversed, so that it flies into an increasing headwind (or decreasing tailwind), airspeed will increase when the shear line is crossed. The theoretical gain is 25 knots.

The effect of wind shear is similar to what happens to a hobo who jumps from a bridge to the top of an express train passing below. As the man leaves the bridge, his ground speed (forward motion) is nil. The train, however, is clipping along at 60 mph. When the hitchhiker first touches down, it should be obvious that he cannot remain on the roof at the point of initial contact. His inertia prevents him from being accelerated so rapidly, from 0 mph to 60 mph. Instead, the hapless hobo will fall and roll backwards with respect to the train. Eventually, the friction of the train acting on his body will accelerate him to 60 mph. Whether he survives to realize this is questionable.

If the unfortunate chap were to misjudge and jump immediately in front of the train, the locomotive would force his body to adapt quite rapidly to the speed of the train. But the acceleration would exert such overwhelming and crushing G-loads that the hobo would instantly regret not having purchased a ticket and boarded the train under more comfortable circumstances.

For those who cannot correlate the hobo and the train with an aircraft in flight, consider this extreme, but illustrative, example. A Cessna 150 is cruising at an airspeed of 100 knots, directly into the teeth of a 100-knot headwind. The 150's ground speed is obviously nil. Assume also that the headwind disappears, suddenly and without warning.

The pilot—just as suddenly—finds himself high and dry without any airspeed whatsoever. The beleaguered 150 pitches down rapidly and loses considerable altitude before the combined effects of diving and power can accelerate the aircraft from a standstill to an airspeed/ground speed of 100 knots in the calm air.

continued

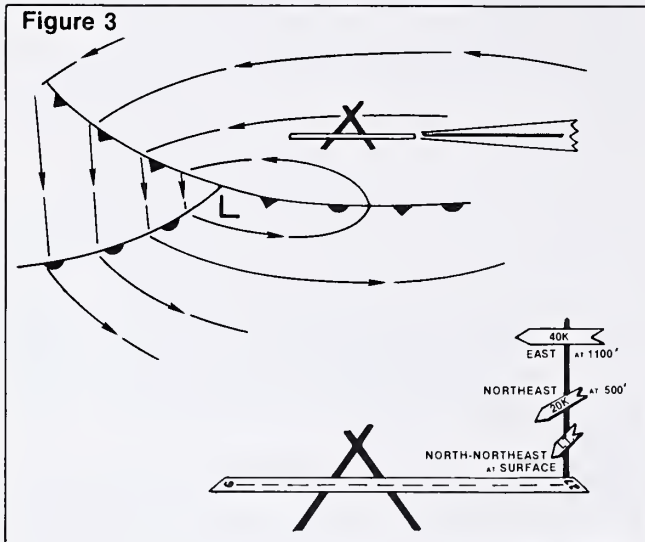
Conversely, had the 100-knot airplane been flying with a 100-knot tailwind, the ground speed would have been 200 knots. The sudden disappearance of this wind would cause an immediate pitch-up, a healthy increase in airspeed (theoretically to 200 knots), and a substantial gain in altitude.

In the foregoing examples, the pitching is a result of longitudinal stability, the designed-in characteristic of an airplane by which it automatically seeks its original trimmed airspeed.

All pilots have encountered some form of wind shear without realizing it. Perhaps, after a period of smooth flight, a pilot runs into a patch of light chop, followed by more smooth air. A comparison of ground speed/drift before and after turbulence might reveal a wind-velocity change. Airspeed fluctuations under these conditions are rarely perceptible, however. The shear line is usually wide, allowing ample time for ground speed to adjust to the new wind condition.

Whenever an approach to landing is made on a gusty day, the pilot is actually encountering numerous wind shears. Every gust of air causes extremely localized shearing. Carefully monitor the indicated airspeed during such an approach and notice how the needle shifts rapidly above and below target airspeed. Some of this erratic needle movement is caused by gusts punching the pitot tube at oblique angles, but, for the most part, actual airspeed varies every time a gust is encountered or left behind.

Figure 3



Curiously, an approach or departure in gusty air is not normally as dangerous as flying through a strong, smooth shear. This is because gusts provide a seat-of-the-pants warning of possible hazards. A pilot is more alert to needed power and attitude corrections. Also, most pilots use slightly higher approach speeds in gusty air to maintain controllability. This also provides a hedge against higher, G-load induced stall speeds and possible airspeed losses due to wind shear.

An excellent rule of thumb suggests that at least half the gust factor be added to normal approach speeds. For example, if the surface wind is reported at 22 knots, gusting to 38, the gust factor is 16 knots. At least 8 knots (half the gust factor) should be added to the normal approach speed.

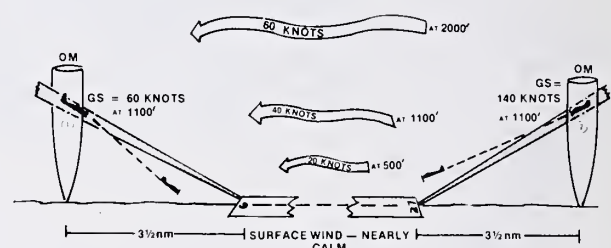
This rule provides ample protection except when the tur-

bulence is caused by nearby thunderstorms. The only protection against this type of severity is to avoid any well-developed cell by at least 10 miles, especially when taking off or landing. A healthy gust in advance of an approaching thunderstorm can quickly steal 20 to 30 knots of airspeed (or more).

Pilots should also be on the alert for local obstacles, on or near the airport, that can disrupt the flow of a reportedly smooth, strong breeze. Figure 2 shows an aircraft about to touch down into a strong, quartering headwind. As the aircraft begins to flare downwind of the large hangar, the headwind component all but disappears, leaving the pilot insufficient airspeed to avoid the impending plop. Numerous hard landings (or worse) can be traced to similar circumstances.

Two small hills are situated farther down the same runway and form a venturi-like constriction. This can change nor-

Figure 4



- ① A "decreasing headwind" gradient can cause (a) an airspeed loss, (b) increased sink rate, (c) possible pitch-down. The result is a tendency to sink beneath the glide slope and a possible undershoot.
- ② A "decreasing tailwind" gradient can cause (a) an airspeed gain, (b) a decreased sink rate, (c) possible pitch-up. The result is a tendency to float above the glide slope and a possible overshoot.

mal wind flow into a river of high-speed air that squirts across the runway from between the hills. Entering such a localized condition could lead a departing pilot to believe that he has sufficient airspeed to fly. But not for long. When this "river of air" has been crossed, the resultant shear causes an airspeed loss that could be sufficient to force the aircraft back to the runway.

When the wind is strong, local velocities are easily affected by topographical features. It is not unusual for windsocks at opposite ends of a runway to point in opposite directions and indicate different wind speeds. A wind shear lies somewhere in between.

Considering the widespread use of sophisticated wind-measuring devices (anemometers), the windsock is somewhat of an anachronism. Unfortunately, however, the wind at the approach end of a runway on a windy day is frequently different from that measured from the roof of a distant, lofty control tower. A few large, brightly colored windsocks strung along the edge of a runway can be more valuable to a pilot than the wind observed by a tower operator. Windsocks allow a pilot to judge the nature and variation of the wind, something a tower report often cannot provide.

The type of wind shear that seems to catch most pilots off guard is the wind gradient, a condition where wind-velocity changes are somewhat more gradual. Although airspeed changes are not as abrupt as in the case of a narrow shear line, the final results have spectacular potential. Gradients are particularly hazardous because flight conditions can be deceptively smooth; pilots are lulled into a sense of complacency and frequently are unable to determine that something is amiss until it is too late.

Figure 3 depicts a wind pattern overlying relatively flat

terrain. Near the surface, the wind is light, flowing directly from high to low pressure. But as altitude is gained, the frictional effects of the ground are reduced and the influence of the earth's rotation (Coriolis force) increases. This causes wind speed to increase and wind direction to shift clockwise (in the Northern Hemisphere) so that above the ground the winds are considerably stronger than at the surface and flow approximately parallel to the isobars.

Figure 4 illustrates the problems encountered when approaching the ILS runway from either the east or the west. Assume that in each case an approach speed of 100 knots is used, and wind velocity over each outer marker (at glide-slope-intercept altitude) is from the east at 40 knots.

When the aircraft is approaching from the east, ground speed over the OM is 140 knots. Over the runway threshold, where the wind is essentially calm, ground speed should be only 100 knots if the target airspeed has been maintained during the approach. During the approach, therefore, ground speed must be reduced from 140 to 100 knots, a deceleration rate of 23 knots per minute.

But if the pilot is unaware of the strong tailwind over the OM, he won't anticipate the need to decelerate. This is the crux of the problem. When a tailwind decreases faster than ground speed is reduced, airspeed is forced to rise. The excess airspeed results in a tendency to rise above the glideslope (either visual or electronic) and, to compound the confusion, a possible pitch-up. Unless judicious control and power adjustments are made during the descent, the aircraft will wind up over the approach lights with excessive altitude and airspeed. The diminishing tailwind (or increasing headwind) approach has been responsible for innumerable overshoot incidents.

If the pilot executing this approach doesn't know why he is experiencing excessive airspeed and why he keeps "floating"

the approach must be increased from 60 to 100 knots. If this is not done, airspeed will decay in proportion to the headwind loss that occurs during the descent.

To avoid sinking below the glideslope, losing critical airspeed, and encountering a possible pitch-down, considerable and seemingly excessive power must be applied during the descent. This poses another threat, since less reserve power is available for a pullup and missed approach. Such a loss of headwind requires considerable pilot attention and action to avoid the potential undershoot. During such conditions, aircraft have developed high sink rates and contacted the approach lights with all engines developing full power. Similarly, aircraft departing into an area of either an increasing tailwind or a decreasing headwind have settled into the ground, also with engines developing full power.

When a pilot finds himself nearing the ground while having difficulty maintaining a safe airspeed/sink-rate combination, he must execute a missed approach and either try again, wait for the wind shear to subside, or divert to another airport.

Anyone who is under the mistaken notion that wind gradients cannot affect him in this manner should be interested in what happened at JFK one day in April 1971. Aircraft approaching the airport encountered a decrease in tailwind of 20 knots per 1,000 feet, and during a two-hour period nine professional pilots executed missed approaches (some diverted to other airports) even though the surface wind was light and the ceiling was 700 feet with adequate visibility below.

The effect of penetrating a squall line, front, or sharp pressure trough (Figure 5) during a left turn deserves particular emphasis. This is uniquely dangerous because an aircraft could simultaneously encounter a rapid airspeed loss because of an increasing tailwind component, a sudden increase in bank angle caused by the side component of the tailwind acting on wing dihedral, a severe downdraft localized at the leading edge of the shear, and turbulence of moderate or greater intensity. Several fatal approach and departure accidents have been traced to these causes.

When you turn away from a squall line (or any severe weather condition), do so with a right turn, not a left one (in the Northern Hemisphere).

With respect to fronts, low-level wind shear can be expected during frontal penetration when the system has a speed of 30 knots (or more) or when the temperature difference across the front is 10°F (or more).

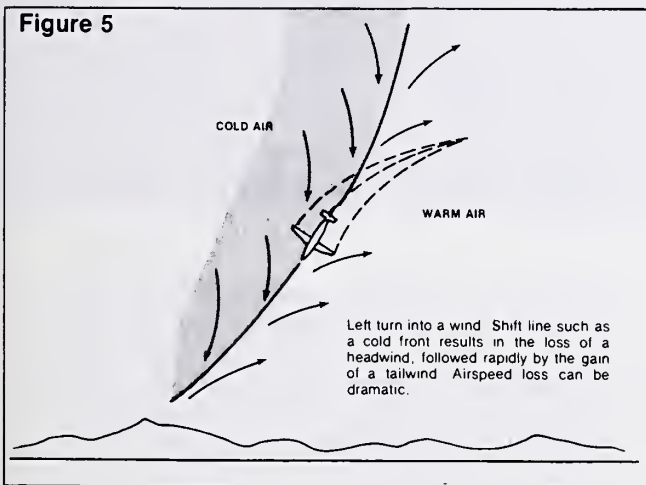
Presently, the pilot's only weapons against wind shear are caution, conservatism, wit, and attention to the elements. But the future may offer some help of a more scientific nature.

NASA and other agencies are working on methods of measuring low-level wind shear. Someday, laser and/or acoustic/Doppler devices may be installed adjacent to some runways and will accurately measure the actual wind profile throughout the approach and climbout corridors. But since wind shear is extremely dynamic and localized, such systems would be required for all runways, something not economically feasible.

Another weakness of a ground-based system is that the necessary data regarding the changing characteristics of a given wind-shear condition cannot be passed on quickly enough to the pilot, who most urgently needs the information. The Air Line Pilots Assn. (ALPA) is pressing for the development of on-board wind-shear sensors, to which pilots could refer during an approach or a departure.

In the meantime—and probably in the future—the general aviation pilot is left to his own devices. He must learn to recognize the existence of wind shear, understand how it can affect his very survival, and, above all, obey one of aviation's most golden rules: "Maintain thy airspeed lest the earth shall arise and smite thee—mightily." Thanks to AOPA Pilot! □

Figure 5



above the glideslope, there is yet another clue (in this case) to warn him of the presence of a wind shear. As the descent continues, the counterclockwise shifting of the wind necessitates a constantly changing crab angle if the aircraft is to remain on the localizer.

This example utilizes a wind gradient of 40 knots per 1,100 feet, or 3.6 knots per 100 feet. During wind-shear studies in Florida and Texas, this has been found to be an average gradient. Low-level wind shears ten times this magnitude (35 knots per 100 feet) have been observed. A gradient of 10–15 knots per 100 feet is not considered unusual.

When the pilot in Figure 4 is approaching the runway from the west, conditions are reversed. Ground speed during

HYDROPLANING



Hydroplaning, a potential “bird buster” is a hazard to wheeled vehicles anytime liquid is present on a hard surface. Although the problem is normally related to the takeoff and landing phase of flying operations, it affects every vehicle that uses tires and pavements. There are few experienced pilots that have not encountered this problem to some extent during their flying career and logged some unscheduled passenger time while still in charge of the aircraft. When you add the additional effects of the crosswinds which are generally associated with showers and wet runways, the hydroplaning problem becomes even more acute. Periodically, it is worthwhile to review this phenomenon in order to bring our knowledge and procedures up to date.

To emphasize the prevalence of hydroplaning, remember one important fact—everytime you

take off or land on a wet surface, the danger of tire hydroplaning is present. Everytime you vigorously apply your brakes (excluding anti-skid) the danger of hydroplaning on liquid rubber is present. Since hydroplaning with its inherent loss of control is and has been a problem for some time, the FAA, NASA, and USAF as well as other organizations and individuals continue to study lift coefficients, vehicle mass friction coefficients, fluid drag and the other intricacies involved in the scientific investigation of the problem.

Ironically, hydroplaning as associated with aircraft, is undergoing considerable study. The automobile, a user of tires and pavements of monumental proportions, is equally susceptible and equally dangerous. Because of this problem, tire and automobile manufacturers have been con-



ducting research in hydroplaning in search of answers to the problem as it affects passenger cars and trucks. Not everyone associated with SAC flies aircraft; but there are very few, including dependents, that do not drive an automobile. Since this is the case, it is reasonable to make use of the research data from aircraft testing as it applies to all vehicles.

What is this phenomenon and what can we do to combat it? Hydroplaning has been defined in technical terms in numerous reports, even reduced to a formula, and then investigated in many separate studies. For our purposes, simply stated it is the condition when pneumatic tires of a wheeled vehicle roll over water-covered, flooded, or slushy pavements causing hydrodynamic pressures to build up between the tire footprint and the pavement surface. Additionally, when mol-

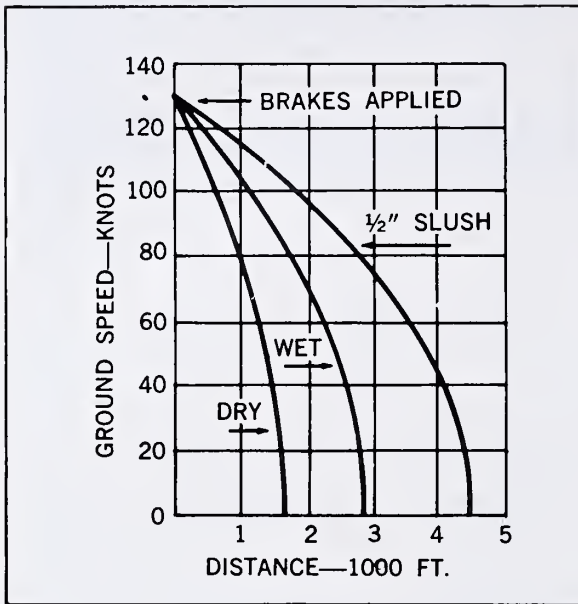
ton rubber accumulates between the footprint and the pavement surface, hydroplaning can occur. As the ground speed increases, the pressure beneath the tire also increases until at a certain critical speed, hydrodynamic lift from pressure under the tire equals the weight of the vehicle riding on the tire. When this condition occurs, hydroplaning speed has been reached. Any increase in speed above the critical speed, lifts the tire completely off the pavement, leaving it supported by fluid alone. This is called total tire hydroplaning.

Photographs and high speed motion pictures taken of aircraft tires under partial and total hydroplaning conditions indicate that a large bow wave forms in front of the tire for all ground speeds below total hydroplaning speed. As the ground speed increases, the angle of this bow wave tends to decrease progressively until at some high ground speed in the total hydroplaning range, the bow wave disappears completely. It is important to note that this is one of the manifestations of hydroplaning that can be witnessed visually. If, during high speed operation in deep water or slush covered surfaces, no bow waves are observed to be forming ahead of the tires, there is a good probability that the vehicle and tires are undergoing total hydroplaning.

The results of several extensive research studies indicate that total tire hydroplaning will not occur on most runways or roads until the pavement is flooded or heavily puddled with water or slush. However, this particular set of circumstances provides the stage for another serious problem when operating a wheeled vehicle on wet surfaces. Take the example of a pavement surface with large areas of standing water or slush followed by areas relatively free of fluid. The resultant skid to non-skid condition can become uncontrollable with little warning. Fortunately, most of our runways are designed with sufficient crown so that water drains away rapidly, but even these runways can become unmanageable during or immediately after heavy rain.

All research indicates that less fluid is required to hydroplane on a smooth surface than on rough pavement. In addition, bald or smooth tires are far more susceptible than ribbed or patterned tread. In most cases, a smooth tire on smooth pavement will hydroplane in only one-tenth of an inch of water. Ribbed tread may require two or three times that amount depending on the tread depth and design. The reason for the difference is that in a new ribbed tire, the fluid has a passage to escape through the grooves of the tread and hydrodynamic pressures do not build up beneath the tires. One development that

HYDROPLANING . . .



shows promise in tests is the striated pavement surface. The system of shallow parallel channels in the pavement surface supplements the tire tread design by allowing additional fluid to exit from beneath the tire footprint, again denying pressure buildup. However, it is recognized that grooving pavements in northern regions might not be feasible because of the intolerable amount of pavement surface deterioration created by the surface water alternately freezing and thawing in the pavement grooves.

The striated surface and improved tread design are only two of the results of experimentation in this field. However, until the problem has been completely eliminated, you must combat the problem that is in existence on the present runways and highways. Probably the simplest method for a vehicle operator to increase control on wet surfaces is to slow down. He must also insure that he is driving on the best possible tires, because results show conclusively that a tire with 85% of its tread worn reacts to the hydroplane hazard exactly the same as one with no tread at all.

Hydroplane research has provided a mathematical formula which allows us to compute hydroplaning speed for any vehicle. The formula applies to smooth or ribbed tires operating in fluid deeper than their tread depth. Expressed as a value, the tire-ground contact pressure is approximated closely by the tire inflation pressure. Using this parameter establishes the mathematical definition of total tire hydroplaning speed in the following formula:

$$\text{Aircraft: } v_h (\text{knots}) = 9 \sqrt{p}$$

$$\text{Automobiles: } v_h (\text{mph}) = 10.35 \sqrt{p}$$

v_h —Total tire hydroplaning speed

p —Tire inflation pressure in pounds per square inch.

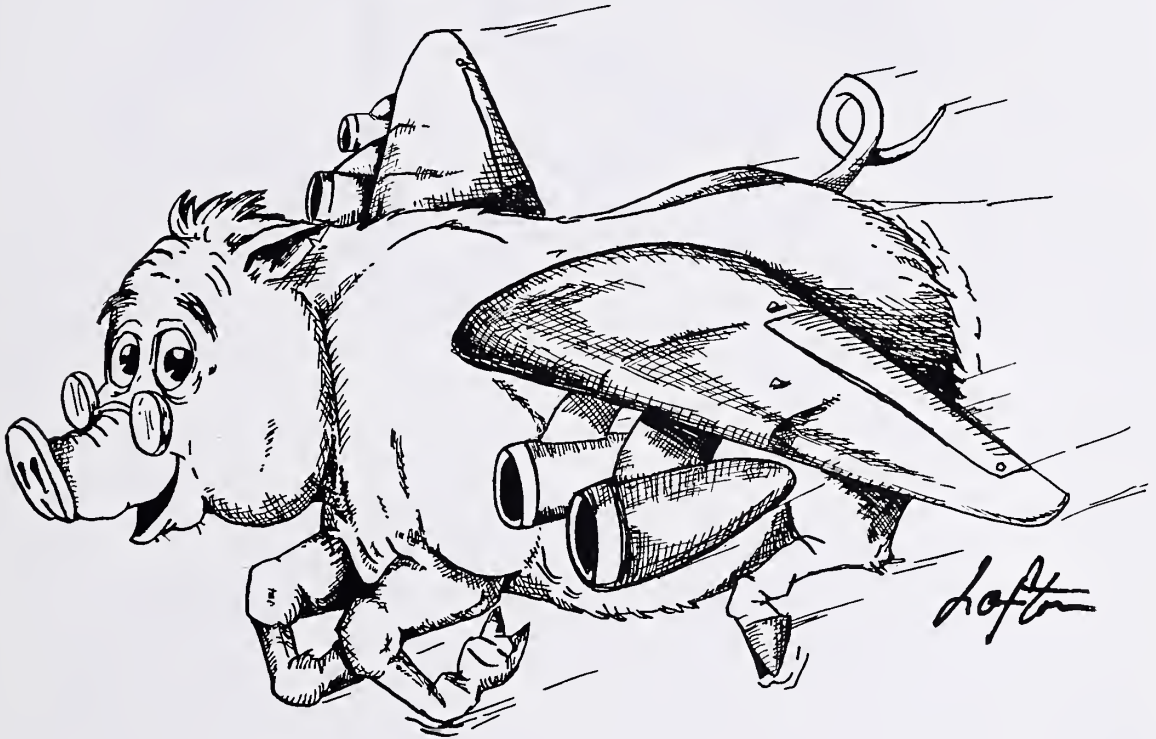
For example, an operating tire pressure of 100 psi would give a total hydroplaning speed of 90 knots on a runway covered with fluid deeper than the tread of the tire. Using the formula for automobile operation with an operating pressure of 28 psi, the total tire hydroplaning speed would be approximately 54 mph. This is not a particularly comforting thought if you are cruising along a freeway at a legal 55 mph.

The figure determined by this formula is that speed at which you have completely lost tire adhesion to the pavement surface. At this speed steering and braking are completely ineffective! Any side force, from either crosswinds or turning moments, may cause a resultant reaction in your vehicle that you cannot counteract. Under hydroplaning conditions, the restrictive lateral capability of pneumatic tires is very small and is easily exceeded by the side force of crosswinds. In one joint test, the loss of directional stability was convincingly demonstrated when it was found that a crosswind of only 9 knots displaced a large four-engine jet transport laterally while it was hydroplaning on the test runway. We know that hydroplaning causes loss of braking traction which in turn increases stopping distance; but how serious is this increase? One test conducted on a wet, but not puddled runway, increased the stopping distance for a large transport aircraft with a gross weight of 150,000 pounds by a factor of 1.6 times the dry stopping distance. On the same runway covered with one-half inch of slush, the stopping distance was 2.6 times the dry runway stopping distance. A rough estimate of the distance required to stop on a flooded runway when hydroplaning is probable would be approximately three times the dry stopping distance. Aircraft performance manuals contain factors to apply to a particular aircraft in order to determine the stopping distance. These factors must be checked carefully before committing yourself to a marginal takeoff or landing situation.

The seriousness of the loss of braking traction and controllability of any aircraft on touchdown or landing need not be emphasized further to a pilot who has already experienced hydroplaning. However, when a landing must be accomplished on very wet runways, hydroplaning research recommends using minimum safe touchdown speed, using a touchdown point near the end of the runway that is consistent with safe

(Continued on Page 22)

ONLY A COUPLE OF HUNDRED POUNDS



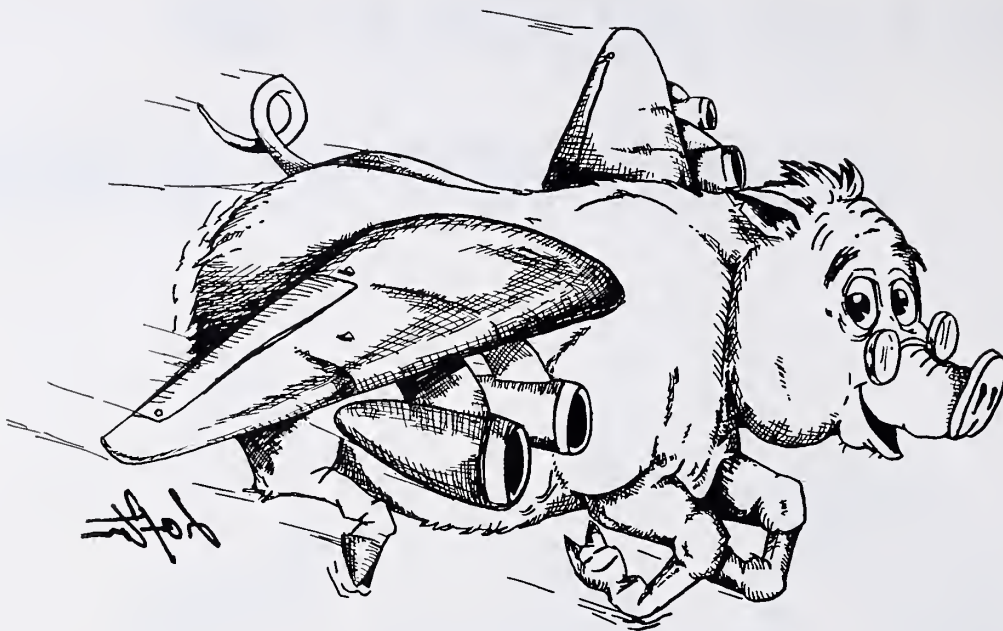
CAPTAIN THOMAS F. KING
903 AREFS, Beale AFB

SAC is encouraging fuel conservation these days. Best range, optimum altitude navigation legs, "endurance plus ten" are causing us to use charts that we haven't used since CCTS. This emphasis on efficient operation means more work and attention to detail for the crew as they mission plan and while they are flying. From time to time we hear the comment "Ah, what the heck, we'd only save a couple of hundred pounds." What is a couple of hundred pounds? The answer, of course, is a lot of things, mostly spelled MONEY. In this case, a couple of hundred pounds is \$13.00. A gallon of JP-4 costs about 42c and weighs about 6.4 pounds. So we are talking about a resource that costs roughly seven cents a pound. Does our response to a \$13.00 savings depend on whether it is the Air Force's

money or our own? All of the services are certainly in a money crunch right now. We in the Air Force are cutting flying hours, equipment and personnel because of tight money. Does the \$13.00 come out of time, equipment or somebody's job? We all have friends who have left the Air Force because cutbacks are unavoidable during a budget crunch.

Let's look at the larger picture—the savings in SAC alone, if each crew could save \$13.00 in fuel per flight, just a couple hundred pounds. Assuming each crew flies at least three times a month, that's 36 flights a year—\$468.00 per year per crew. SAC-wide, that computes to well over half a million dollars a year!

Now let's look at it from on an international basis. We import a large quantity of crude oil used for fuel production. The fuel we waste means more dollars spent abroad. These factors, in turn, have an adverse effect on our overall energy resources as well as our balance of payments.



If the foregoing doesn't serve as a motivator and the only money we are concerned with is that which comes out of our own pocket, let's look at your next efficiency report. Your wing commander is going to have to be very point-conscious when the top efficiency reports are signed. Just as he has only so many dollars to spend, he has only so many one and two ER's to spend. If you are aggressively helping him save funds, you are more likely to be favorably considered when the difficult budgetary question of who gets what ER blocks is decided. No matter how we look at it, or what motivates us, we can't afford to overlook that couple-of-hundred pounds.

Fuel, time, and dollar conservation all begin even before mission planning. The alert scheduling officer should assure that the takeoff fuel load isn't more than required to fly the mission with required reserves. If he is really on his toes, he will periodically review his scheduled fuel loads and adjust for seasonal changes in weather and temperature. It just doesn't make sense to carry more fuel than necessary to meet mission requirements.

Plan your flights at optimum altitude. But keep in mind that a climb to an optimum altitude 4000 feet above the ARCP just 10 minutes prior to arrival could easily use more fuel than leveling at the hemispherical altitude just below the air refueling altitude. If, on approaching the ARCP, you receive word that your receiver has been delayed for an indefinite period, you have a number of options: a) Await the receiver, orbiting at orbit

altitude and 275 KIAS. b) Refer to the orbit holding speed chart for the air refueling altitude. c) Climb to optimum altitude and refer to the orbit holding chart—or to the endurance chart if above 30,000 feet. Flying at endurance plus 10 knots will compensate for the speed bled off in the turns. Be certain how long you are likely to be delaying and maximize the time with an alternate activity such as a precision navigation track, or practice of controlled arrival times while holding a TACAN orbit. These activities can keep you reasonably close to the ARCP and maximize the training time for available to you and your crew. Don't forget to descend in plenty of time for the rendezvous. It would be a little embarrassing to roll out three miles in front of and 6000 feet above your receiver.

If your receiver is going to be really late or has canceled, you may be able to save fuel with a pre-planned navigation leg using the ARCP as a start nav point. It is extremely wasteful to fly a 30 minute air refueling track before continuing the mission. Present costs of operating the KC-135 are above \$1300.00 per hour. Flying a 30 minute leg just to avoid a little skull work during mission planning will waste \$650.00 or more.

Returning to your home station, consider an enroute descent. Or better yet, use an enroute descent to an ILS or other approach if you don't really need a published penetration. If properly planned, you won't put the boards up and then have to pour on the fuel to compensate for leveling too many miles out.

Transition training is also something that should

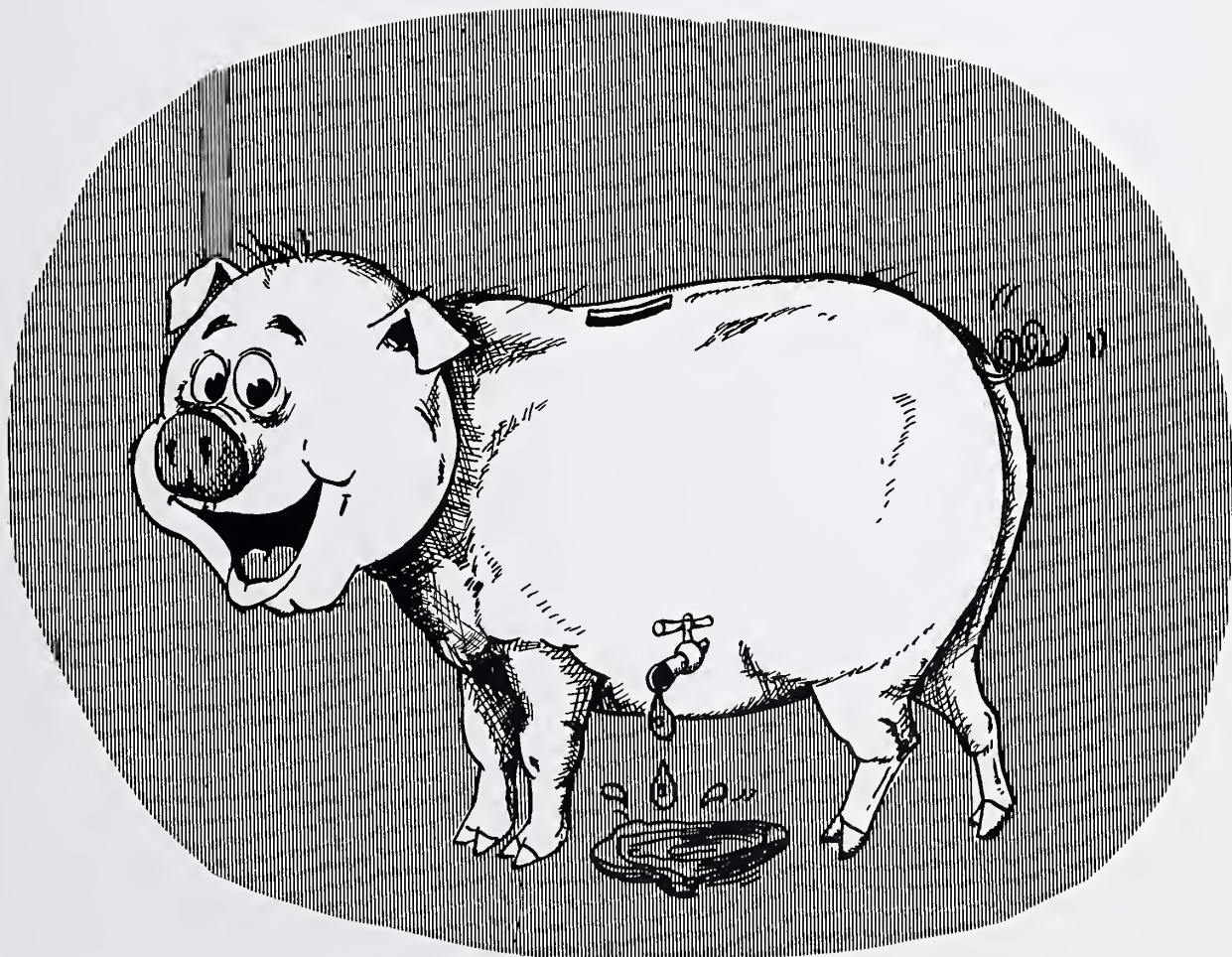
be planned well ahead of time. When shooting multiple low approaches, raising the gear between each approach will save fuel. Of course, use the Dash One procedures for touch and go landings. Quite a good suggestion really, it takes a lot of power to taxi in with the gear up. Always follow your Dash One if it outlines specific gear procedures. Let the controller know what you'd like to do after your next approach. Your first turn out of traffic will probably come more promptly, thus saving additional fuel. Relay all requests quickly so the controller can have more time to satisfy your requirements.

How about your throttle technique? Do your engines go "Boing, Boing, Boing," or do they go "Hummmmmmm"? Smooth throttle technique and little deviation from planned airspeeds do yield better fuel economy. Even if fuel conservation is not your strong point, good crew coordination is enough to dictate close control of airspeeds. The more true airspeed varies during a navigation leg, the longer the frown on the navigator's face, especially during a basic night celes-

tial grid leg.

A good staff can follow-up and provide feedback on fuel conservation. How much fuel have the aircraft been landing with? Does the navigator's log and copilot's Form 76 indicate that the crews are actually flying at the optimum altitude that was planned? At what airspeeds are the navigation legs accomplished? Most command posts request the fuel status at the initial approach fix. Does anyone tally this against planned, in order to adjust the original fuel loads? Does anyone tell the scheduler, "Hey, we can do this mission in December with less fuel than it takes in July." How fine-tuned is the staff to supporting a vigorous fuel conservation program? A little communication goes a long way.

By working separately, staff, maintenance, and crews can probably do more toward fuel conservation. By working together as a team, we can do a lot more. Are you consistently doing everything possible to complete the mission in the most economical manner possible? If so, SAC is proud to have you on the team.



HYDROPLANING—

(continued from page 18)

operating practices and procedures, and early use of spoilers and deceleration devices to decrease the landing roll.

If you are forewarned of the risk of using slushy or puddled runways and understand the hydroplaning problem and formula, aircraft and vehicle operators can foresee the hazards they will encounter and the approximate speed at which they will occur. What you must remember is that total tire hydroplaning is synonymous with complete loss of control. Partial hydroplaning, such as occurs when less than all tires have reached the total hydroplaning condition, is also a serious situation. When this set of conditions exists, the vehicle is under control only for an exact set of circumstances; when something disturbs this precarious balance—such as a tire traversing a raised portion of the pavement or a section with less fluid covering—the resulting reaction may easily exceed the operator's capabilities to respond. On a highway, conflicting traffic may preclude that simple response necessary to avoid a collision, or the momentary loss of control will be of sufficient magnitude to affect another vehicle enough to once again result in a collision. When you understand the many variables affecting vehicle operation on wet surfaces, you can see that moving faster than the posted safe speed, when negotiating a curve, is definitely not safe under wet road conditions. This is true because you initiate dangerous side forces into a situation where they cannot be controlled.

Aircraft operating on wet runways are faced with the problem because their rigid speed schedule almost always brings them into the hydroplaning range during takeoff and landing. With the addition of gusty surface winds, it is easily explained how an aircraft departs the runway in spite of all efforts to control its direction.

There is no doubt that hydroplaning can cause a serious problem to vehicles, but if you understand something of the nature of the problem, you have taken a giant step towards coping with it. Some considerations to keep in mind when operating on wet runways or highways are:

Aircraft

—If possible, avoid takeoffs and landings on water or slush covered runways, especially in a crosswind.

—Slow the taxi speed and be especially careful when cornering.

—Minimum runway techniques and aerodynamic braking can be used if your flight manual permits. Know your aircraft procedures.

—Use wheel brakes with caution.

Asymmetrical drag will start dangerous side loads.

—Bald or excessively worn tires and wet runways are not compatible.

Vehicles

—Replace tires before they are smooth.

—Use intermittent braking techniques.

—On wet roads, triple your normal interval between vehicles.

—Remember that posted speed limits are established for ideal conditions such as dry pavement, visibility unrestricted, car and driver in peak condition and non-conflicting traffic. If any of these conditions are less than optimum, reduce speed accordingly.

—Patches of water or slush are extremely hazardous. These conditions can cause partial tire hydroplaning at well below posted speed limits and affect your ability to control the vehicle.

—Slow down on wet roads.



BIG INSTRUMENT

LEARN FROM OTHERS

CAPTAIN JOHN L. WILSON
1 CEVG, Barksdale AFB

During 1 CEVG visits over the past year we have noted that certain problems come up quite frequently. The following paragraphs discuss the instrument or instrument related areas that have caused the most frequent substandard activity. They are presented here not to necessarily help you pass your next CEVG evaluation, but in the interest of flying safety and the hope you can learn from the mistakes of others.

Problem: Nonadherence to ATC clearance.

Probable causes: Inattention to clearance/aircraft position; confusion or misunderstanding of clearance by one or more crew members; reluctance to obtain clarification or advise of deviation or possible deviation.

Solution: First, copy all ATC clearances as they are received. Write them out and make sure you get all of the information. This will prevent confusion between the clearance you expected to receive versus the one actually given. It also gives a ready reference for use later in the flight when the altitude or clearance limit may have slipped your mind. After copying each clearance, ensure that the entire crew understands it. Get clarification if there is some part you do not understand. If you are confused when receiving the clearance, then it is impossible to know for sure you are following what ATC intends for you to do.

Once the clearance is understood it is the responsibility of the pilots and navigators to adhere to it. Crew coordination plays an important role. Many of the failures in the ATC clearance area involved one or more crew positions. Had effective and proper crew coordination taken place many of the unqualified grades in ATC Clearance and Crew Coordination would not have occurred. The steps to ensure compliance include: monitoring the aircraft, advising of approaching altitudes, fixes, headings, etc., and ensuring that

the appropriate action is taken once that point is reached.

Compliance with ATC clearances is generally easy with proper monitoring and crew coordination. It is, however, a continuous process from engine start through engine shutdown. Although the ultimate responsibility rests with the aircraft commander, other crew members have an important role in compliance, which requires the vigilance and coordinated effort of all.

Problem: Instrument departures and approaches (procedures and tolerances).

Probable cause: Lack of proficiency in basic instruments; attempting to fly and perform other duties at the same time; unfamiliarity with published routings.

Solution: Adherence to tolerances can only be resolved through continual practice. If you are having tolerance problems, review the basic instrument procedures of flying attitude instruments and cross checking the performance and navigation instruments. Know the approximate attitude picture/power settings for your aircraft for the different phases of flight as well as the attitude/power change required to go from one flight condition to the next. Then, think and make small corrections to the attitude or power to correct to the desired performance.

Make every effort to reduce your workload when actually flying the aircraft. If you find yourself giving many directions to the crew, or are performing items other crew members could and should be doing, then your crew coordination is lacking and instrument tolerances are going to suffer. When the out-of-the-ordinary problem arises that requires your attention, transfer control to the other pilot or engage the autopilot.

Use the flying time available to you as effectively as possible. Instead of automatically engaging the autopilot at level off and leaving it on

BIG INSTRUMENTS

continued

until approaching the IAF, hand fly the aircraft as much as possible. Use secondary climbs and descents as well as straight-and-level flight to practice your basic instrument techniques.

Adherence to departure and approach routings can only be accomplished by being completely familiar with the routing and by properly monitoring the navigation equipment. First, determine the accuracy of your instruments by checking at a known ground check point (AFM 51-37, page 8-3) prior to each flight. Brief the routing to be used, how the navigation radios are to be set, and when they are to be changed. Preset initial courses and headings on your equipment prior to execution of the maneuver, and plan far enough ahead to prevent changing courses or heading references at the last instant.

Pilots and navigators should monitor the aircraft position, altitude, and attitude, with reference to the intended route. If you observe a deviation, notify the pilot immediately. Keep the pilot flying the maneuver updated on the next phase. Navigators should be backing the pilots on the routing (using radar, doppler, RMI cards), altitude, and volunteer information such as wind drift, approaching altitudes, and navigation errors.

Problem: Compliance and Directives.

Probable causes: Lack of knowledge; reluctance to advise other crew members of observed deviations.

Solution: Know the directives at least as well as you know your duties and aircraft systems. This is going to require continuous study on your part to keep yourself up to speed. A once a year review during Instrument Ground School is not nearly enough. The regulations and manuals are available in many places on the base if you do not happen to have your own personal copy. The CIF, squadron administrative section, alert facility, a friendly aircraft commander or IP, or the base publications library are a few places to find copies of the various regulations and manuals. In flight, when you suddenly have to know a rule, it is too late to dig through a regulation.

These three areas are broad and have been covered in somewhat general terms, but they have been the reasons for the majority of the instrument T's and U's over the past year. Use them to take a close look at yourself and your crew. Incidents and accidents can be prevented, but it is up to you. 

THE YOUNG PROFESSIONAL SAC CREW FORCE

(Continued from page 3)

under study, and is a certainty of the future. However, a major key to continued success is a thorough knowledge of existing directives, and publications. Here lies the experience gathered in 30 years of operation. This vast wealth of information is probably the most important source of training available to the relatively inexperienced crewmember. By maintaining familiarity with the publications applicable to his specialty—drawing upon the combined knowledge of those who have greater experience—the crewmember can extract an absolute maximum from the flying sorties or training exercises provided to him.

This particularly holds true, I believe, in gaining experience in the operation of degraded equipment. Mission accomplishment is more in jeopardy when lesser experienced aircrews encounter other than optimum conditions, e.g., inoperative Doppler, poor aircraft radar, Minuteman motor-generator malfunction, or LCC computer lockup. But a thorough knowledge of how others have coped with similar situations will give any crew member a fighting chance when faced with a problem for the first time. In summary, the SAC record has dispelled all doubts as to the ability of our younger crew force. However, limited resources and corresponding reductions in our capabilities to train combat crews pose new and difficult problems which we must overcome. We will continue to maintain today's high levels of proficiency as long as we have true professionals manning our crew force. Being a professional has nothing to do with age—it involves complete job knowledge and a personal dedication to the SAC mission. It involves a self-discipline and inner drive directed toward being the best crewmember in the force. I believe the highest compliment to the command will continue to be a reference to "SAC's young, professional crew force." ★★



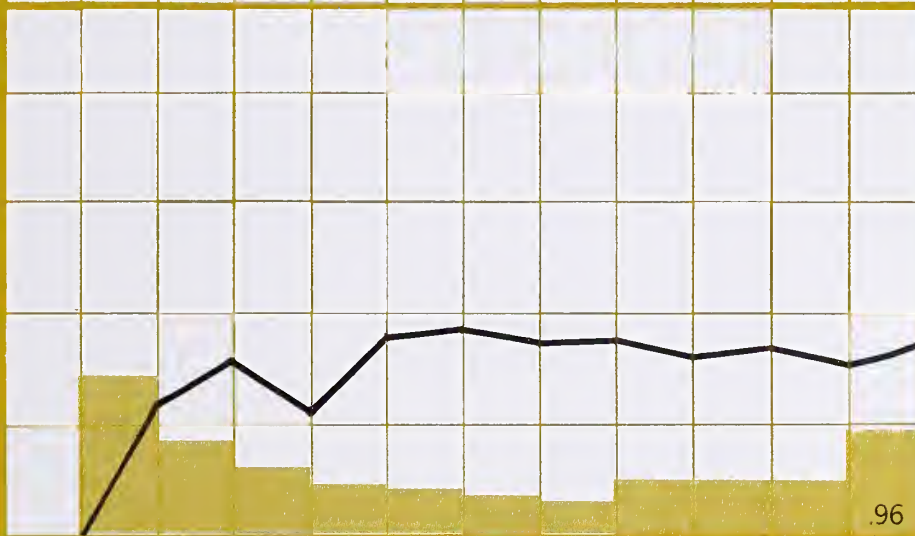
1975 Flying Safety Rate



SAC MAJOR ACCIDENT RATE (PER 100,000 FLYING HRS)

1974 RATE .00 1.27 1.63 1.20 1.88 1.96 1.69 1.76 1.56 1.64 1.49 1.58

4
3
2
1
0



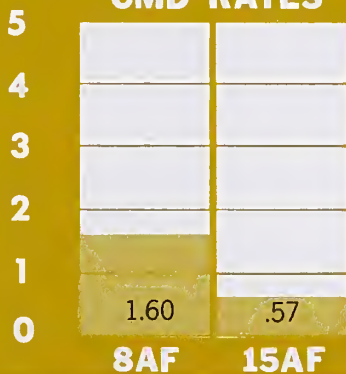
.96

ACCIDENTS JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

1974 0 1 1 0 2 1 0 1 0 1 0 1

1975 0 1 0 0 0 0 0 0 1 0 0 2

1975 SUBORDINATE CMD RATES



ACCIDENT STATUS

FB-111
B-52G
KC-135
FB-111

FEB 75
SEP 75
DEC 75
DEC 75

LEGEND =1974 RATE

PROFESSIONAL PERFORMERS

Individuals selected for these pages as SAC's top professional performers of the month are chosen from nominations made by all SAC units. Selection is made only after all nominations have been carefully screened and those chosen meet the highest standards of excellence as outlined in SACR 127-2.



PILOT

Ellsworth AFB B-52G instructor pilot, Captain Harvey L. Zimpel, demonstrated outstanding flying proficiency and knowledge of aircraft systems when he prevented a major aircraft accident and probable loss of life during a combat crew training mission. At the termination of the 8.5 hour mission, Capt Zimpel was in the left seat instructing the copilot through the penetration and approach phase. He encountered a slight rolling moment during wing flap operation in light turbulence. He recognized the asymmetrical wing flap condition and immediately took corrective action to counteract the unusual rolling and yawing moment. Placing the flap lever to off, he executed a missed approach and climbed to a safe altitude. He declared an emergency and accomplished the appropriate emergency procedures for his flap condition. Checks were made for controllability and initial buffet speed to determine the speed range through which the aircraft could safely be flown. Realizing that a landing with the asymmetrical flap condition would be necessary, he computed a best flare speed for the intermediate flap setting and directed the aircraft to a safe landing. Throughout the emergency, he coordinated all activity with the Ellsworth Command Post and supervisory personnel. Capt Zimpel demonstrated a high degree of professional competence in handling the potentially serious asymmetrical flap condition.

PROFESSIONAL PERFORMERS



TITAN Crew R-062, 308 SMW, Little Rock AFB: MCCC Captain Donald G. Morrow, DMCCC 1Lt James L. Wilks, MSAT A1C Steven E. Black, and MFT A1C Charles J. Johnson.



Maintenance Man. Sergeant Charles L. Campbell, 341 Strategic Missile Wing, Malmstrom AFB.



MINUTEMAN Crew E-062, 341 SMW, Malmstrom AFB: MCCC 1Lt Bruce Lamartine, and DMCCC 2Lt Robert Ladow.

THE ENLIGHTENED SPECIES

THE EMERGENCE OF A NEW IMAGE FOR AIRCREW MEMBERS



LT COL RICH PILMER, SSGT JOE DENHOF
Aerospace Physiology Unit, George AFB, CA

Perhaps the image of a pilot as a chap who can "hold his liquor," represents the vestiges of an endangered but improved species. Recent emphasis on Air Force briefings concerning 30-19, Drug Abuse, and 50-27, Aerospace Physiology, has placed renewed vigor in a drive to make not only aircrewmembers, but all Air Force personnel enlightened about the hazards of alcohol abuse.

To learn more about contemporary knowledge, attitudes, and practices of Air Force personnel in relation to alcohol, we tested some 300 individuals ranging from colonels to the lowest ranking enlisted on topical questions about the why, when and "so what" of drinking. As an introduction to the laws, safety rules, and physiology of alcohol, our questions are presented below. Before we give the results of our experiment, test yourself to determine your alcohol I.Q. Then we hope you will read further to establish a firm alcohol I.C. (I Care) for your better health and safety.

1. T F It is possible to become an alcoholic by drinking only beer.
2. T F Approximately 50% of automobile and 20% of private, light aircraft accidents are related to individuals apparently under the influence of alcohol.
3. T F While operating a motor vehicle in most states, a blood alcohol level of .08 - .10 mg% or greater is against the law.
4. T F Aircrewmembers should allow at least 12 hours between consumption of alcoholic beverages and flight duties.
5. T F In terms of the number of people involved, alcoholism is probably the nation's number one drug abuse problem.
6. T F Alcoholics are happy people who rarely have psychological problems.
7. T F Alcohol causes a warm sensation in the skin due to the constriction of peripheral blood vessels.
8. T F An individual of average size could probably consume five (6%) beers within one hour and not exceed a blood alcohol level of .10mg%.
9. T F Cirrhosis of the liver is not significantly related to excessive, chronic use of alcohol.
10. T F Alcoholics who eat well do not tend to get diseases of the liver.

If you said the first five were true and the last five were false, give yourself a perfect score. You are as knowledgeable as 80% of our aircrewmembers. Now read on to find out more about our results with attitudes and practices.

For years we have said "You must allow 12 hours between bottle and throttle," but we wanted to go beyond documented facts and get some of our student's own ideas.

We anticipated some "far out" responses from our students who had not yet received our pitch about driving or flying and drinking. Such as one officer who in response to the question; Why do you consume alcoholic beverages? said simply; "None of your damn business."

To the same questions others were more cooperative and generally less obtuse. For example:

"That's where the broads are."

"Saves heating costs in winter."

"Like the taste of olives soaked in it."

"I collect swizzle sticks."

"You have to, to be allowed in bars."

One troop also played on our test with his own originality by listing his name as Jones, John J., rating: E-1, Enlisted Janitor; age 19, height 4'6", weight 264 pounds. His whole approach to our questions was that he never took to drinking because he was too busy eating.

After weeding out the wise guys (or boozing out the wise weeds) we came to these conclusions for our efforts.

Of some 300 crewmembers, ranging in age from 20 to 60 years, 50.2% pilots, 17.8% navigators, and the bal-

ance enlisted aircrewmembers, 0% said they never drank! That's right, 100% said that at one time or another they had consumed alcohol. Actually, 94.3% said they presently drank on occasion; while 5.7% said they no longer partake at any time.

Of those who presently indulge, 12.5% said they have tried to stop, but 87.5% said they didn't even want to stop.

Perhaps on the more cheerful side we found that only 53.2% consider themselves dispo-maniacs or weekly drinkers, while only 16.2% said they consume alcohol in some form on a daily basis in "moderate" quantities.

Those who reported monthly drinking numbered 13.5% while 17.1% said they "rarely" ever had any alcohol.

While the number of alcoholics in the Air Force is imputed to have increased in recent years, it is felt that personnel today are generally much more aware of potential dangers and problems associated with chronic overuse. USAF Hospitals have initiated more effective treatment and rehabilitation centers while on the training side, new, more honest, emphasis on alcohol as a drug has been promulgated along with illegal drugs.

Apparently, some of this training has had beneficial effects because in 1973-74 accident statistics, there were no Air Force aircraft accidents ascribed to alcohol use. While Air Force people generally didn't do much better on the highways than their civilian counterparts, the trend is well established to eliminate the image of aircrewmembers as guzzling gassers.

Among reasons reported for quitting or decreasing the use of alcohol were (from most to least):

1. Expense
2. Health or physiological reasons
3. Religious beliefs
4. Personal efficiency or performance
5. Didn't enjoy it, hangovers, etc.

For those who had no interest in changing any of their drinking habits, the reasons for drinking (most to least) were tallied as:

1. Social reasons
2. Relaxation - nerve and tension relief
3. Enjoyment and pleasure
4. Taste thirst
5. Habit

Interestingly, this rather hedonistic group tended to overlook health and professionalism as objectives. While others have reported similar data on our society at large, we know of no report on the practices of aircrewmembers per se; and while we don't anticipate international recognition for this study, we feel that our objectives have been met if you acknowledge THE DANGERS OF ALCOHOL:

1. Possible dangers of chronic alcohol abuse
2. The law and alcohol abuse
3. The importance of abstinence for an absolute minimum of 12 hours before any kind of flight duties.
4. A bad hangover can cause you to be a fuzzy thinker - Even if it has been 12 hours since you had a drink.



HALL OF FAME

TACTICAL FLYING

OVER SIXTEEN YEARS

916 AREFS, Travis.....Sep '59

OVER FIFTEEN YEARS

97 BMW, Blytheville.....Mar '60

410 BMW, K. I. Sawyer.....Oct '60

19 BMW, Robins.....Oct '60

OVER THIRTEEN YEARS

11 AREFS, Altus.....Feb '62

301 AREFW, Rickenbacker.....Jul '62

96 BMW, Dyess.....Aug '62

449 BMW, Kincheloe.....Aug '62

OVER TEN YEARS

320 BMW, Mather.....Jul '65

OVER EIGHT YEARS

92 BMW, Fairchild.....Feb '67

55 SRW, Offutt.....Jul '67

2 BMW, Barksdale.....Aug '67

319 BMW, Grand Forks.....Dec '67

OVER SEVEN YEARS

22 BMW, March.....Feb '68

OVER SIX YEARS

5 BMW, Minot.....Feb '69

42 BMW, Loring.....Oct '69

93 BMW, Castle.....Nov '69

OVER FIVE YEARS

28 BMW, Ellsworth.....May '70

OVER FOUR YEARS

509 BMW, Pease.....Nov '71

ICBM

OVER TWELVE YEARS

381 SMW, McConnell.....Nov '63

OVER ELEVEN YEARS

90 SMW, F. E. Warren.....July '64

1 STRAD, Vandenberg.....Sep '64

OVER TEN YEARS

308 SMW, Little Rock.....Aug '65

To gain listing in the Hall of Fame, a SAC unit must be accident-free for 48 months.

SAC Safety Screen

The SAC Safety Screen is an honor roll of SAC's most professional crews. To gain listing on the Screen, crew members must be nominated by their unit commanders and meet high selection criteria of experience in their aircraft or missile system IAW SACR 127-2.



416 BMW, Griffiss Crew E-17: P Capt Robert L Ostrander, CP 1Lt Lyle L Johnson, CP 1Lt Forrest K Dahmer, RN Capt Leonard J Novak Jr, N 1Lt Patrick J Casey, EWO 1Lt Jeffrey N Knieriemen, G Sgt Edward A Ranzenbach

509 BMW, Pease Crew E-125: AC Capt Ian J Hayes, CP 1Lt Donald T Milkavich, NN Capt Lee R Meneses, BO MSgt Leslie M Harton

42 BMW, Loring Crew R-116: P Capt Michael D Wallace, CP 1Lt Dale E Frost, CP 2Lt Charles J Fries, N Capt Rudy Escobar, BO SSgt Robert J Nering

379 BMW, Wurtsmith Crew E-44: FP Maj Robert M Marquette Jr, CP Capt David B Walker, CP 1Lt Charles D Pinkard, RN Capt William D O'Brien, NN Capt David A Fox, NE 1Lt Michael N Schulman, AG AIC Joseph N Robertson

44 SMW, Ellsworth Crew E-191: MCCC Capt Rudolph R Federman, DMCCC 2Lt Leland M Caulder Jr

90 SMW, F E Warren Crew S-205: MCCC Capt John E Towry, DMCCC 1Lt Dana M Spears

91 SMW, Minot Crew E-024: MCCC Capt Duane J Harings, DMCCC 2Lt Clifford M Terrell

321 SMW, Grand Forks Crew E-097: MCCC Maj Roy W Nichols Jr, DMCCC 1Lt Robert W Crusoe

351 SMW, Whiteman Crew E-134: MCCC Capt Michael P Altieri, DMCCC 1Lt Jon R Pearse

381 SMW, McConnell Crew S-110: MCCC Capt Paul W Hiday, DMCCC 1Lt Hugh P Hensil, MSAT TSgt Ronald E Long, MFT Sgt Calvin W Brown

390 SMW, Davis-Monthan Crew E-091: MCCC 1Lt William T Harrison, DMCCC 2Lt Gill S Paszek, MSAT Sgt Madison Smith III, MFT AIC Robert R Johnson

351 SMW, Whiteman Crew R-122: MCCC 1Lt Allen G Kliebert Jr, DMCCC 2Lt Bura R Hewitt

5 BMW, Minot Crew R-05: P Capt Dennis G Kasselmann, CP 1Lt Gerald W Dunn, RN Capt James A Huggans, NN 1Lt Paul S Gardes, EW 1Lt Richard R Digney, AG SSgt Danny L Herzner

9 SRW, Beale SR-71 Crew: P Capt Eldon W Joersz, RSO Maj George T Morgan Jr

22 BMW, March Crew R-16: P Capt Jerome K Braden, CP 1Lt James K Colman, RN 1Lt Randy L McElroy, NN 1Lt Pasquale B. Ionta, EW Capt John R Aberle, AG Sgt Daniel N Jones

96 BMW, Dyess Crew E-17: IP Capt James W Hunter CP 1Lt Arthur L Bennett Jr, CP 1Lt Richard D Jepsen, RN Maj Doddridge H Nevitt Jr, NN 1Lt Neil D Smith, EW 1Lt Doyle C Daughtry, AG SSgt Loy G Newlun

92 BMW, Fairchild Crew R-26: P Capt Fred D Remke, CP 1Lt John H Payne, CP 1Lt Lewis H Williams, RN Capt Timothy Youngbluth, NN 1Lt Landry H Smallfoot, EW 1Lt William E Curtis, AG Sgt Granville B Lane III

916 AREFS, Travis Crew R-110: P Capt Richard K Skersick, CP 1Lt Thomas L Thrasher, NN 1Lt James M Dionne, BO SSgt Roger E Plank





In the SPIRIT of '76'



The days of the manned aircraft are by no means numbered as some of the prophets of doom are wont to claim. I cannot foresee the time when we can do without manned weapon systems.

Missiles are excellent strategic weapons, because of their tremendous speed which makes them ideal against "time-sensitive" targets. But no computer can duplicate man's reasoning power and his uncanny ability to make on-the-spot decisions. Moreover, we must anticipate the possibility that an enemy may develop effective anti-missile defenses which could seriously impair our deterrent unless we have enough advanced manned aircraft in our inventory to preserve a retaliatory capability.

For these reasons, SAC must maintain a mixed force of manned and unmanned weapon systems in which one complements and supplements the other and in which we can exploit the unique advantages of both to the fullest. It is still too early to predict exactly what the mix will be but there can be no doubt that manned weapon systems will play a vital role in our strategic inventory for the foreseeable future.

Looking still further into the future, I believe that, eventually, there will be manned strategic spacecraft designed to protect the Free World against any threat from space and to insure the preservation of space for peaceful pursuits which is the stated objective of this country. If this should come to pass, I am convinced that it will be men from SAC who will be called upon to man such spacecraft.

Thus, the young rated officers in the Air Force have indeed a promising future ahead of them as long as they can meet the ever increasing demands which will be placed on the air and space crews of tomorrow. When I started to fly over 35 years ago, I could not have possibly anticipated the challenges entailed in operating today's high-performance aircraft. But what I have seen and experienced in those 35 years will pale into insignificance compared with the flying challenges facing the men who are just beginning their Air Force career today.

General Thomas S. Power, February 1964